Before The
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter Of	)	
Implementing a Broadband Interoperable Public Safety Network in the 700 MHz Band	)	PS Docket 06-229
Service Rules for the 698-746, 747-762 and 777-792 MHz Bands	)	WT Docket 06-150

COMMENTS OF INTERISLE CONSULTING GROUP

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Introduction

The Upper 700 MHz D Block partnership represents a rare opportunity to modernize Public Safety communications at relatively little cost to state, county and local governments. Public Safety radio systems are not the same as commercial mobile wireless systems. They are optimized for different purposes. This makes the D Block opportunity unique.

A Commercial Mobile Radio Service (CMRS) operator will naturally optimize its system based on cost and revenue expectations. Service is delivered where local and roaming demand is sufficient to create profits. Resiliency is limited; to the extent that it substantially increases cost, it is rarely merited. A system that works well under normal circumstances may fail during time of public emergency, just when public safety needs are the greatest. A partnership system must therefore include architectural and design features that differ from a typical CMRS network. The requirements of Public Safety agencies cannot be met by simply migrating Public Safety applications onto CMRS networks, even if that appears, at first, to be the low-cost option. Nonetheless there is much to be gained by leveraging CMRS technology on behalf of Public Safety users. Technologies such as WiMAX and especially LTE are very promising for both types of application. The devil is in the details.

As former technical consultants to Frontline Wireless, Interisle Consulting Group understands the issues that led to the incomplete conclusion of Auction 73. We work with both Public Safety organizations and commercial entities, and are keenly aware of the differences between their respective requirements. Nonetheless we believe that a successful re-auction of the D Block, following the partnership model, is possible. In these comments we describe the features that we believe would lead to a successful re-auction.

Partnership model has three parties in the auction

Most spectrum auctions are bilateral affairs between the bidder and the public, who is represented by the Commission. The partnership model proposed for the D Block is fundamentally different. It is essentially two transactions between three parties. It is both an auction purchase of commercial spectrum by the D Block Licensee from the Commission (on behalf of the Treasury), and it is a procurement of a nationwide public safety network from the D Block Licensee by the Public Safety Broadband Licensee (PSBL, on behalf of the various Public Safety agencies).

In a conventional auction, the bidder can make its own rational estimate of the value of the license, which it can base on its own estimates of both the cost to build the network and the revenues that it can make from it. This process is well established and was successful in the case of Auction 73's other blocks.

The Public Safety side of the three-way transaction has been the more problematic. The cost side of the equation is impacted by the uncertain demands of the Public Safety Broadband Licensee, not just for the lease of its spectrum but the operational details of the network itself, which in Auction 73 was suggested in the BID. Even more importantly, both costs and revenues are uncertain. A potential bidder's actual valuation of the D Block is thus based on combining the anticipated net values of both transactions.

In a normal competitive procurement situation, the buyer specifies its requirements in some degree of detail; the bidder then proposes what it can provide, for what price, and is contractually held to meet the stated obligations. A DBL partnership licensee must likewise commit to meet the defined performance, resilience, survivability, and interoperability needs of Public Safety users.

The potential DBL bidder will need to estimate both its commercial costs and revenues and its Public Safety costs and revenues. The latter users are represented by a third party, PSST, which has had the effective ability to impose requirements upon DBL which in turn may have a severe impact on the financial aspects the public safety portion of the business. Commercial usage of the DBL may or may not be sufficient to cover the cost of the Public Safety system, and hence the procurement side of the transaction (net costs borne by the DBL) may have a larger initial dollar value than the commercial spectrum auction side (net profits to the DBL). If that turns out to be the case, no positive minimum bid can be met, and the net payment may well need to be in the opposite direction – the winning bidder may have to be the one who asks the least for the procurement of a Public Safety network, its cost only partially offset from its commercial revenues as the DBL. The direction of this cash flow may well depend upon the nature of the requirements placed upon the DBL by the PSST.

Cost-causative Public Safety requirements must be clear

It can be argued that economically, a procurement and an auction are essentially similar, except for the net balance of payment. A "reverse auction" in which the bidder is the one who receives the least payment (whether this is viewed as a subsidy or procurement) can even be combined with a regular auction; the auction mechanism will determine the direction in which payments flow. Such an auction would have no minimum bid; it could even be bid below zero, meaning the bidder's procurement revenues exceed auction payments. Even if a DBL does make a positive payment in the auction, its responsibilities to the PSST are such that it needs to also be treated as a procurement, with similarly well-defined and enforceable requirements.

These procurement requirements thus need to be made clearer before the D Block auction can be successfully concluded. The BID or its successor cannot be a wish list of all of the potential goodies that the PSST might like, subject to one-sided negotiation. The Public Safety functional requirements should be spelled out for what they are, the procurement of a nearly-nationwide network. While the eventual winner of the D Block auction may have to negotiate many details with the PSST, the procurement requirements need to be firm enough so that potential investors in the network can reasonably determine the value of this unusual proposition.

That was clearly not the case for Auction 73. The process must be made attractive to qualified bidders. Requiring up front expenditures in the form of auction fees as well as commitments to recurring expenditures in the way of licensing fees to PSST are strong disincentives for any player to step up to meeting the needs for a national network built on the D-Block and PSB-Block. Again, the procurement costs, to the Public Safety community, of the network may be offset by leasing revenues, but these are simply part of the balance of payments that needs to be factored in to the three-party competitive procurement.

Not all Public Safety agencies will be network users

Among other changes, buildout requirements need to be adjusted to reflect the fact that potential Public Safety users may choose to not utilize the system. Auction 73's premise was imbalanced; it required the DBL to provide service but did not require Public Safety agencies to buy it. This is different form some European cases where Public Safety agencies are essentially required to use a shared network.

States and even localities could choose to maintain their own radio systems. Some states have already built new systems within the past few years, or are in the process of doing so, and would thus be relatively unlikely to make large-scale use of a 700 MHz partnership system within the next few years. Because potential Public Safety users are not required to make use of the system, they may not be paying network service fees to the DBL, or otherwise compensating DBL for constructing networks in areas where commercial utilization alone may not cover the cost.

Other industries share the needs of public safety for resilience, survivability and interoperability. The financial, transportation, chemical, energy, and power industries also need networks that can be relied upon under all circumstances. The National Guard should also be able to leverage a national wireless public safety network. New applications for remote sensors and controllers could emerge if a sufficiently resilient network were available. Properly crafted policies could bring these industries and specialty users onto the public safety playing field to help assure a stable market for sustaining the network. This could help offset the absence of some Public Safety agencies from the network.

The coverage mandate must be more flexible

The 99.3% benchmark for year 10 coverage of the population is unrealistically high. While simply lowering the percentage would be useful, coverage should be addressed in a more rational manner than merely mandating an arbitrary percentage hurdle. Here is where local input could help considerably. For instance, the public safety officials in an urban area understand what sort of coverage they need, while public safety organizations in a sparsely populated rural region are likely to know where they do, and do not need coverage.

This is also an area where the needs of other industries should be factored in. In a country as diverse as the U.S., the one-size-fits-all approach is not appropriate. The need for costly indoor coverage, vs. outdoor/mobile coverage, also should be treated flexibly. What may make sense in an urban area may be needlessly costly in rural areas or for highway coverage. Hence a two-tiered approach like that proposed, with a lower-cost buildout in areas where public safety needs do not require a costlier service, is appropriate. But it should also be accompanied by a reduction in mandated coverage area.

We independently arrived at the 99.3% of the population number when evaluating the population of the United States on a 5-digit ZIP Code Tabulation Area (ZCTA5) basis, using commercially-available population estimates for each such area. This is somewhat more granular than the county-based analysis described by the Commission, without drilling down to the smaller census areas. Our methodology involved dividing all ZIP codes into five categories, Dense Urban, Urban, Suburban, Rural (>7 pops per square mile in the ZCTA5), and Rustic (excluding Alaska, areas with <7 pops per square mile across the ZCTA5). The latter category includes roughly one third of the land area of 49 states, with less than one percent of the population. The 99.3% benchmark required essentially 100% land area coverage of all Dense Urban and Urban areas, 98% coverage of Suburban land area, at coverage of Rural land area (in a way that reaches 99% of the rural population, which is to say 100% coverage of rural towns and cities and most farmland, which we estimate to be least 70% of its total land area), and coverage of virtually all remaining isolated communities in rustic areas with a population of at least 2500.

While this is a laudatory goal, practical realities are that 100% coverage can rarely be achieved, even in urban areas. *Some* small areas may fall between the cracks, especially for indoor-grade coverage, due to the inability to put up cell sites where desired. Local zoning is often very hostile to wireless carriers, and required cell sites may simply not be available. In areas where the local Public Safety agency makes use of the system, it may sometimes have sufficient influence to overcome these barriers. But the benchmark as written applies regardless of whether or not the public safety agency is on board. Full coverage is a goal, but cannot be realistically guaranteed. Thus the 99.3% benchmark is simply unattainable, at least via terrestrial means.

We suggest instead that the D Block Licensee be required to build out the network to a significantly lower baseline percentage of the population, such as 90%, for essentially standard outdoor-grade coverage, but be required to provide coverage to the other areas *that could fill out* a 98% benchmark if the public safety agencies in those areas make a bona fide request and commit to make use of the system. Indoor-grade coverage could also be provided upon request by a Public Safety user of the system, as could coverage to additional rustic areas, provided that the requesting agency provides adequate compensation for the exceptional costs of such service. Such compensation could come at least partially in kind, such as providing access to state fiber optic networks, towers, etc.

Mobile satellite coverage may be appropriate in some locations, especially rural and rustic areas. It is not, however, a panacea: Satellite telephones are large, consume more battery power than terrestrial wireless radios, and are still subject to path failure due to terrain, foliage, and other issues. They generally do not work indoors.

They are also considerably more expensive. Hybrid satellite-terrestrial coverage may be a useful tool for achieving rural and rustic-area coverage, while retaining a reasonably-priced broadband wireless service in areas where terrestrial coverage is practical. But the requirements of the vast majority of first responders will best be met by terrestrial means. Nor should the price of satellite-based service be averaged in to the price charged to all users. This sort of cross-subsidy is inherently dangerous. By raising the price in areas with a low cost to serve, it may discourage usage of this network. Subsidies, if needed, should be explicit, and funded from a more appropriate revenue source.

Backhaul is a huge cost item

In our modeling of the cost of building a nationwide 700 MHz network, one of the biggest costs was backhaul between the radio towers and the rest of the network. The simplest Public Safety radio repeater systems do not require backhaul; they are, however, not connected to the Internet, to the PSTN, or to other agencies. This is precisely the type of non-interoperable system that needs to be updated.

This procurement *also* necessarily includes assistance in creating interoperability between the disparate Public Safety networks that exist today, as well as with the proposed new 700 MHz radio access network. Interoperability between public safety systems is fundamentally a wireline problem. The many first responders and public safety agencies are no longer well served by separate systems. Many police officers carry both their own agency's dispatch radio system and a CMRS telephone, the former for urgent push-to-talk applications and the latter providing a crude form of interoperability. The major challenge to Public Safety communications is not limited to building broadband radio coverage. It is fundamentally about providing links between the different agencies and their various networks.

Any broadband CMRS system, including the DBL's, will require connectivity to both the PSTN and to the Internet. Broadband usage on a bit-per-user basis will be far greater than current CMRS mostly-voice usage, and thus radio tower sites will require more backhaul capacity than the CMRS status quo. At the present time, the bulk of CMRS backhaul is provided by Incumbent Local Exchange Carriers under Special Access tariffs. In its 2003 Triennial Review of the Section 251 unbundling obligations of ILECs, the Commission ruled that CMRS is not entitled to make use of cost-based Unbundled Network Elements. In the pending WC Docket 05-25, the Commission is evaluating the appropriate rates for Special Access. Current rate levels are in general supracompensatory. While this may encourage facilities-based competition in some highly desirable locations, and encourages bandwidth-intensive customers to locate their facilities (such as data centers) in sites that are along competitive fiber, such policies are inimical to the goal of widespread, affordable nationwide coverage by a DBL/PSST partnership.

In our modeling of the potential cost of building the Frontline Wireless network, we found that backhaul leased line cost, both from the tower to a relatively local aggregation point and from there to a backbone point, was a major source of operating expenditure, especially in rural and rustic areas. Based on typical current Special Access tariffs and using microwave to reach almost a third of cells – an extremely optimistic number, compared to current practice – the estimated annual cost of leased-line backhaul for the fully-developed network was approximately one billion dollars per year. Most of this can be seen as a subsidy flow to the incumbent local exchange carriers.

Cell sites cannot, of course, be located at carrier hotels. Some cell sites can be served by private microwave, but that is far from universally practical. Furthermore, the need for higher-than-commercial levels of resilience will require that at least some towers have redundant backhaul; in some sites this will mean both private microwave and leased lines.

The cost of backhaul on a per-subscriber basis is highly dependent on location. Because of the Auction 73 buildout requirement that required 99.3% coverage of the population, cell sites had to be built in remote areas, many with as few as 2500 to 3000 local residents, and many of these locations over 100 miles away from a first or second tier city. Even if connectivity were only two DS1 circuits, the going rate for a 100 mile DS1 Special Access circuit is approximately $2000/month, sometimes higher, so a typical rustic cell site could cost $4000/month in backhaul. If there were only 100 subscribers in that cell's coverage range – and that is optimistic for a new entrant in the CMRS business – then the cost of backhaul alone for each subscriber would be roughly as much as the typical CMRS carrier's monthly subscription fee. This is no doubt one reason why CMRS coverage in rural and rustic areas is so limited, and it poses a similar threat to the economic viability of a truly interconnected, interoperable broadband public safety network.

There are two obvious ways in which this cost can be ameliorated. One is to reduce the buildout requirement, so that the D Block Licensee does not have to built out to 99.3% of the population, and can forego buildout where the local public safety agencies in a given area do not subscribe to its services. That would, of course, also reduce capital requirements, as noted in the FNPRM.

The second is to reduce the price of backhaul charged by carriers with market power. This is another reason why the 99.3% benchmark needs to be made more flexible. Competitive supply is unrealistic in most areas, again especially so in rural locations (many of which are served by small ILECs already subsidized by the Universal Service Fund), but also at many urban and suburban sites where there are no competitive backhaul providers, where microwave antennas can not be installed or paths are not available. Backhaul needs to be made available at predictable, fair prices. While the Wireline Competition Bureau is theoretically not party to this proceeding, a prompt resolution of WC 05-25 could have a substantial impact on the likelihood of its success.

Appropriate technical strategy and flexibility is needed

Public safety and other public/private sector interests in regional and national resilient network services go beyond mere deployment of a new 700 MHz wireless network. A long-term strategy is desperately needed that evolves more resilient/survivable/interoperable communications services that can transcend any one technology. Let's face it: Just about the time the new 700 MHz national network is fully deployed (using the most optimistic scenarios), some new technology will have emerged that changes the entire approach for wireless/mobile communications.

From today's perspective, "4G" CMRS technology appears to be the appropriate starting point for the construction of this network. Its key technology, LTE (the optimistically-named Long Term Evolution), is said to be coming onto the market in 2009, allowing the first prototype-level 700 MHz systems to be built during its early-adopter phase. By 2010-2011, as the 700 MHz network is (one hopes) being built apace, 4G gear should be ramped up to volume levels. But it was only a decade ago that "3G" was being talked about as the Next Big Thing, so by 2019, an LTE network may well be on its way to obsolescence. This is simply the way of the world in CMRS, where the analog first-generation network has been largely decommissioned and current equipment is often built to 3G standards, with 2G still supported. Public Safety communications has, at least up to now, been more technologically stable. Systems are not replaced as often; end user radio devices are not built for the two-year replacement cycle now characteristic of most CMRS. Evolutionary strategies for the joint network will need to accommodate both sets of user expectations, which will be a challenge.

Decentralization is part of survivability

One of the key features of the Public Safety network must be high survivability. This necessarily involves a degree of decentralized control. In many areas, CMRS is served from remote Mobile Switching Offices. For example (based on the LERG Routing Guide), in LATAs 448 and 450 on the Florida panhandle, the "big four" CMRS providers only provide service through Mobile Switching Offices (MSOs) located elsewhere, such as Mobile and Montgomery, AL and Jacksonville, FL. Not a single wireless carrier shows any switching gear in LATA 456 (Daytona). Only a small local carrier has its own switch in sprawling LATA 638 (Bismarck, ND). This is a common pattern; large CMRS providers see economies in centralization.

In the 4G LTE architecture, the switching function is further decentralized. The part of the MSO control plane that maintains connections with moving users, the Mobility Management Entity (MME), is separate from the packet-switching core (SGW) that supports the bearer plane. More than one MME can be used in the same network. Likewise, the Call Agent function that manages VoIP telephone calls and other voice activities can be anywhere. While the CMRS norm may well be to have large, centralized MMEs and Call Agents, public safety networks need to stay alive even when connectivity in and out of a local area is disrupted by storm, earthquake, fire, attack, or other unforeseen event. These control plane functions may thus have to be replicated locally, even if only for backup (emergency standalone) purposes. This sort of architectural construct, localization and redundancy of control, should be required of a Public Safety network, even if the specific technical means of implementation is allowed to evolve over time.

Redundancy should not be over-specified

Other aspects of survivability should be defined in functional terms that balance the requirements of Public Safety with cost effectiveness. For example, redundant backhaul and power systems may be desirable, but overlapping cell coverage could often suffice as well. With the advanced beam-forming antenna technology characteristic of 4G systems, cell coverage engineering is flexible, allowing cells to be inserted into a pattern without physically modifying existing cells. Cells are installed for both coverage and capacity reasons. As usage grows, cells are split to gain capacity. If one cell then fails, however, adjacent cells could fill in.

Another option is for microcells to be deployed on street lights, utility poles, or similar locations. Again these do not necessarily have the capability of local power generation or redundant power, but they may have sufficient overlap in their coverage to make the network as a whole survivable and resilient against single-point failures. They may also make use of a "mesh" radio network for the first stage of backhaul. A mesh network may have varying degrees of redundancy to any one of its nodes, depending on the location in the mesh topology, but overall can provide high resiliency across its service area. Hence the functional requirement is for resilient coverage, not redundant power supplies or backhaul links per se. Adding implementation requirements that raise the minimum cost of a cell site may have the perverse effect of reducing overall system resiliency by preventing small-scale, low-cost components from being part of an overall solution.

Respectfully Submitted,

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